

Briefing on IPCC Fourth Assessment Report, Working Groups I & II

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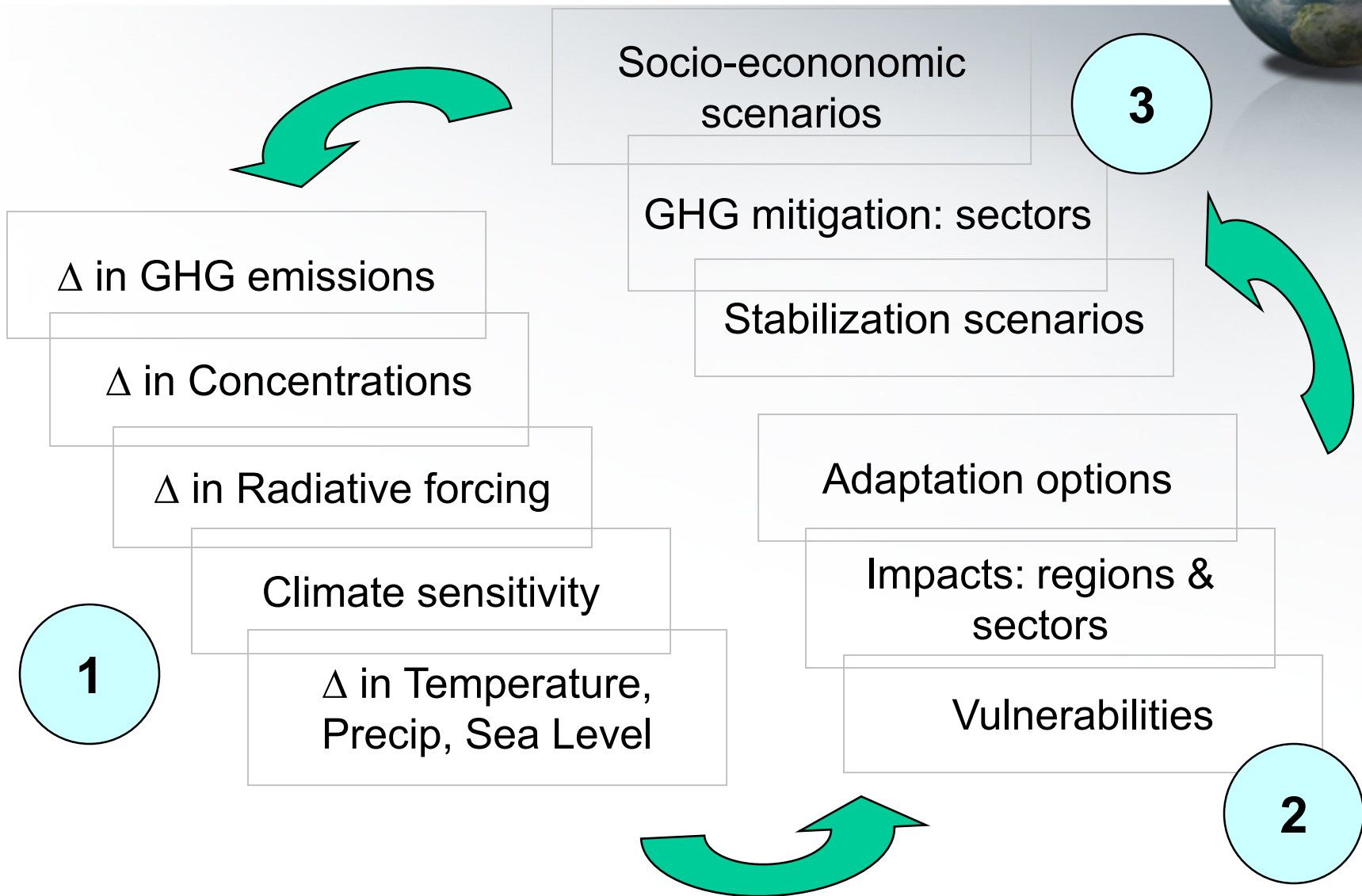
IPCC Fourth Assessment Report (AR4) Schedule



<u>Working Group I (WGI)</u> <i>Physical Science</i>	<u>Working Group II (WGII)</u> <i>Impacts, Adaptation, and Vulnerability</i>	<u>Working Group III (WGIII)</u> <i>Mitigation</i>
Summary for Policymakers, or SPM, approved (Feb. 1)	SPM approved (April 6)	SPM to be approved (May 4)

**November 2007:
IPCC Synthesis Report**

Scope of IPCC Working Groups I, II and III



Each Summary for Policymakers is approved line by line by government delegations



IPCC Statements of Likelihood and Levels of Confidence



- Likelihood indicators
 - Extremely likely: >95% (probability of occurrence)
 - Very likely: >90%
 - Likely: >66%
 - More likely than not: >50%
 - Very unlikely: <10%
 - Extremely unlikely: <5%
- Confidence indicators
 - Very high confidence: At least a 9/10 chance (of being correct)
 - High confidence: About a 8/10 chance
 - Medium confidence: About a 5/10 chance
 - Low confidence: About a 2/10 chance
 - Very low confidence: Less than a 1/10 chance

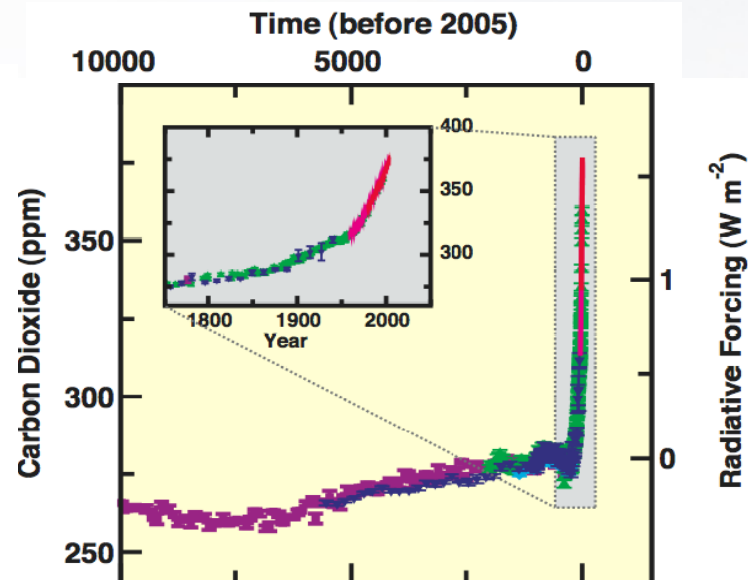
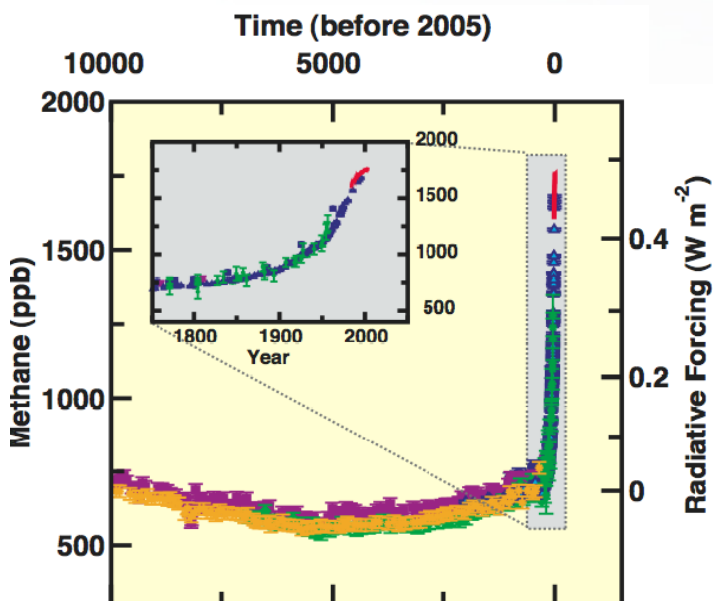
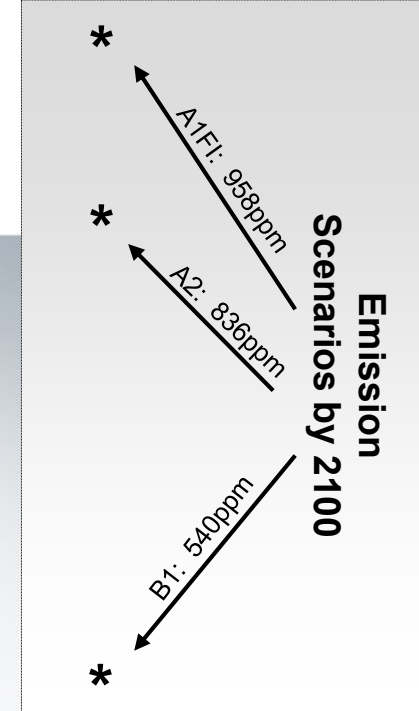
Contents of IPCC Working Group I Report



- Summary for Policymakers
- Technical Summary
- Historical Overview of Climate Change Science
- Changes in Atmospheric Constituents and Radiative Forcing
- Observations: Surface and Atmospheric Climate Change
- Observations: Changes in Snow, Ice and Frozen Ground
- Observations: Oceanic Climate Change and Sea Level
- Paleoclimate
- Couplings Between Changes in the Climate System and Biogeochemistry
- Climate Models and their Evaluation
- Understanding and Attributing Climate Change
- Global Climate Projections
- Regional Climate Projections
- List of Authors, Reviewers and their Affiliations

CO_2 & CH_4 Concentrations

Atmospheric concentrations of CO_2 and CH_4 in 2005 far exceeded the natural range over the last 650,000 years.

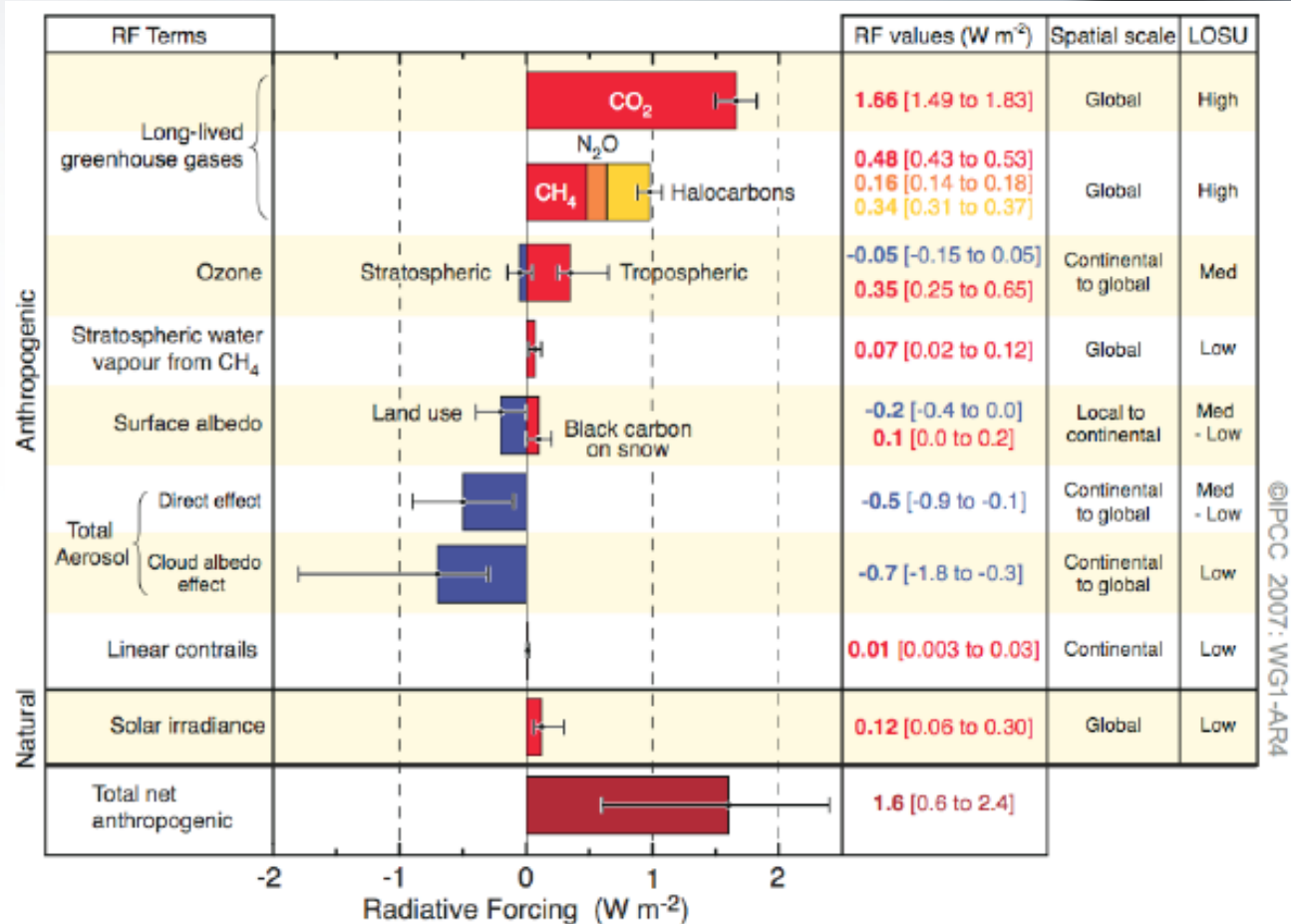


Source:
IPCC WGI
AR4, 2007.

Radiative Forcing Effects of GHGs



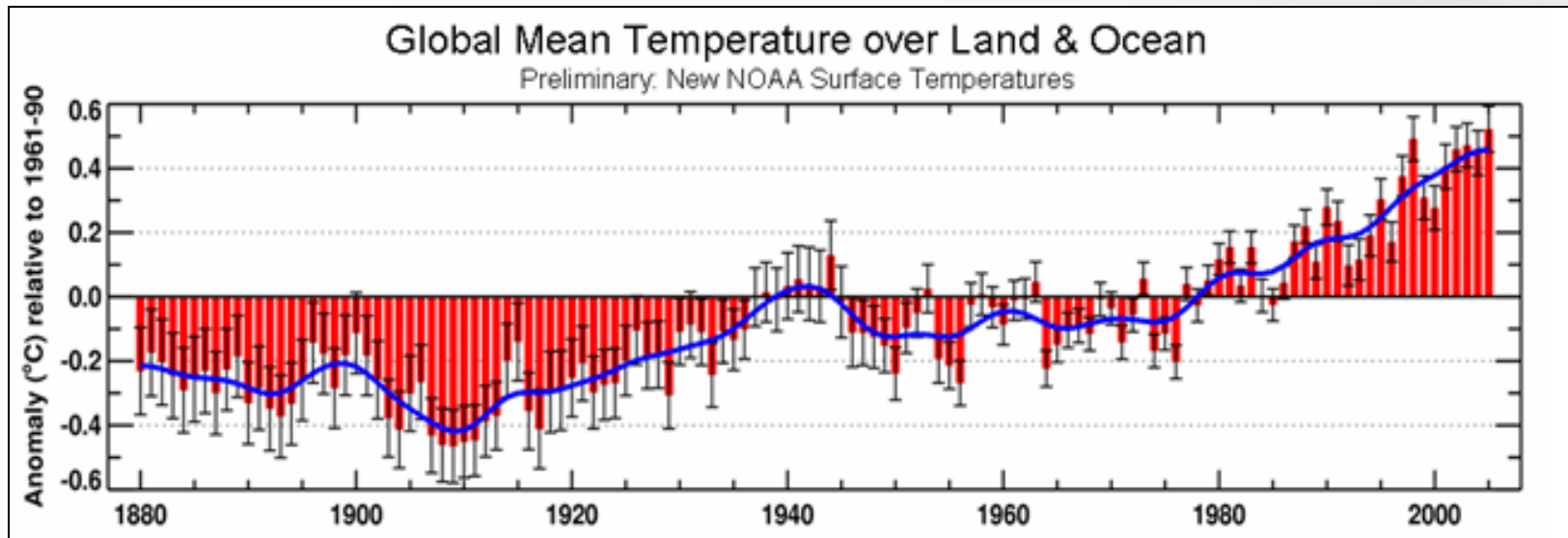
- Understanding of anthropogenic warming and cooling influences on climate has improved.
- Very high confidence that net effect of human activities since 1750 has been one of warming, with a radiative forcing of $+1.6 \text{ W/m}^2$.



Observed Global Warming



Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level

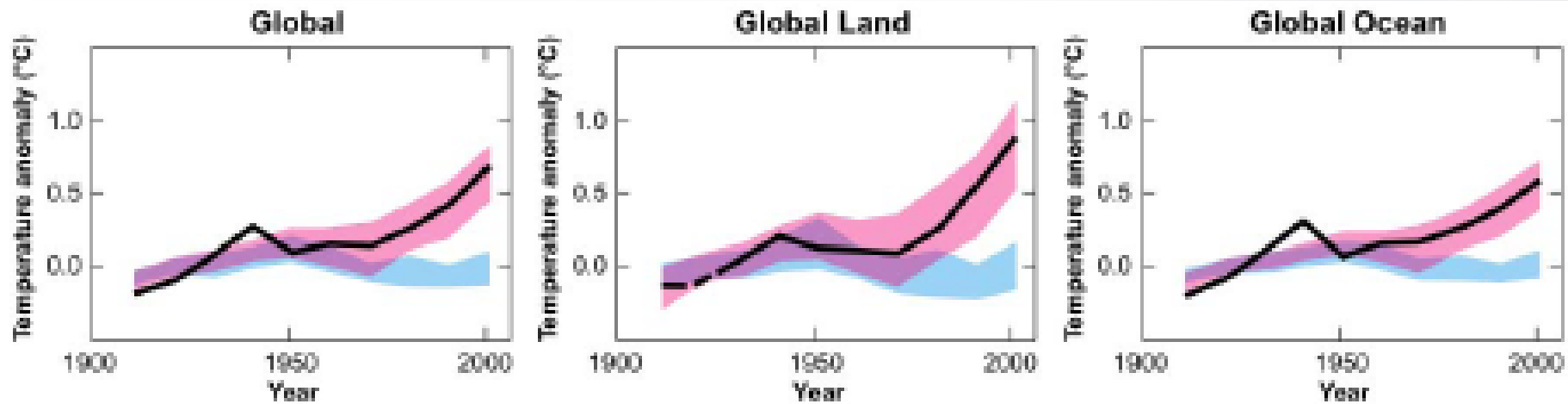


Global average warming in the past century is 0.74°C (1.3°F)

Attribution of Observed Global Warming to Anthropogenic Emissions



Most of the observed increase in globally averaged temperatures since the mid 20th century is very likely due to the observed increase in anthropogenic GHG concentrations



Black line is observed warming

Blue area is 5-95% range from 5 climate models using only natural forcings

Red area is 5-95% range from 14 climate models using both natural and anthropogenic forcings

Future Global Temperature Projections



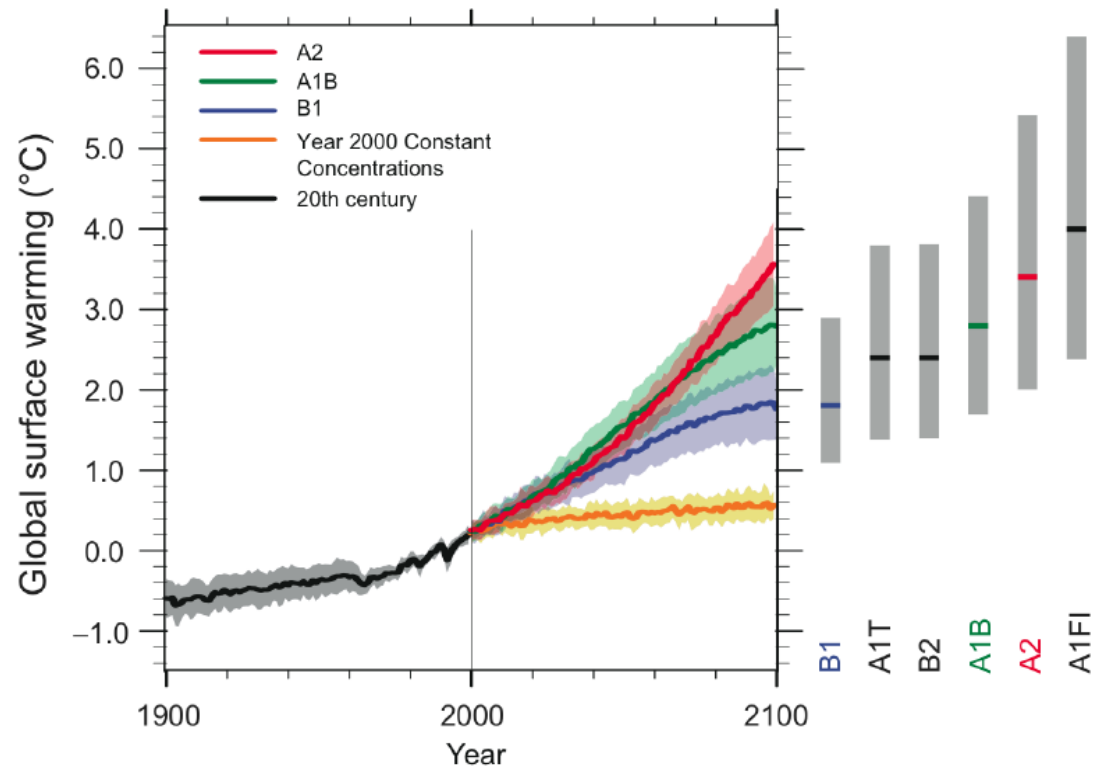
Continued GHG emissions at or above current rates would cause further warming and induce many changes in the global climate system during the 21st century that would very likely be larger than those observed during the 20th century.

IPCC global temperature projections by 2100 relative to 1990:

Best estimate = 1.8 to 4.0°C (3.2 – 7.2°F)

Likely range = 1.1 to 6.4°C (2.0 – 11.5°F)

Under the IPCC 'business-as-usual' emission scenarios, warming and sea level rise would continue for centuries beyond 2100



Future Sea Level Rise Projections



Case	Temperature Change (°C at 2090-2099 relative to 1980-1999) ^a		Sea Level Rise (m at 2090-2099 relative to 1980-1999)
	Best estimate	Likely range	Model-based range excluding future rapid dynamical changes in ice flow
Constant Year 2000 concentrations ^b	0.6	0.3 – 0.9	NA
B1 scenario	1.8	1.1 – 2.9	0.18 – 0.38
A1T scenario	2.4	1.4 – 3.8	0.20 – 0.45
B2 scenario	2.4	1.4 – 3.8	0.20 – 0.43
A1B scenario	2.8	1.7 – 4.4	0.21 – 0.48
A2 scenario	3.4	2.0 – 5.4	0.23 – 0.51
A1FI scenario	4.0	2.4 – 6.4	0.26 – 0.59

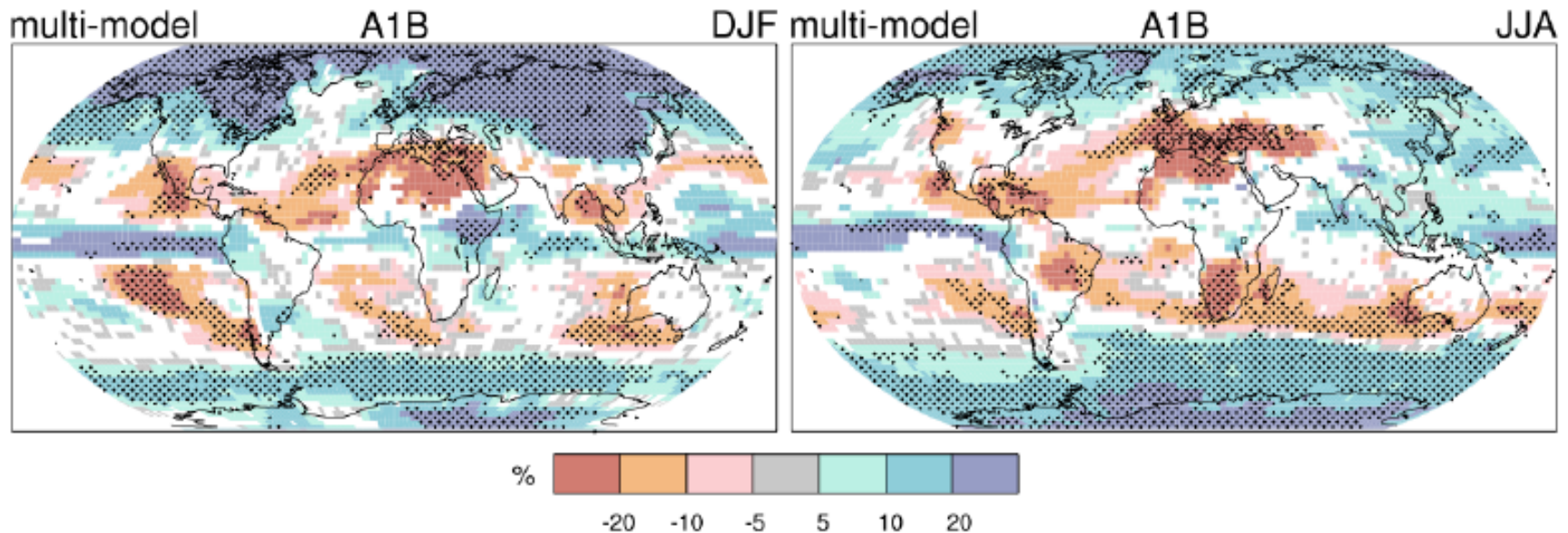
- Estimates do NOT include the increased ice discharge from Antarctic and Greenland ice sheets.
- This could add 0.1 to 0.2 m to the upper range of sea level rise projections.

Projected Precipitation Changes



“Since the TAR there is an improving understanding of projected patterns of precipitation. Increases in amount of precipitation are very likely in high-latitudes, while decreases are likely in most subtropical regions.”

PROJECTED PATTERNS OF PRECIPITATION CHANGES



Contents of IPCC Working Group II Report



- **Summary for Policymakers**
- **Technical Summary**
- **Assessment of Observed Changes**
 - Assessment of Observed Changes and Responses in Natural and Managed Systems
- **Assessment of Future Impacts and Adaptation: Systems and Sectors**
 - New Assessment Methodologies and the Characterization of Future Conditions
 - Fresh Water Resources and Their Management
 - Ecosystems, Their Properties, Goods and Services
 - Food, Fiber and Forest Products
 - Coastal Systems and Low-lying Areas
 - Industry, Settlement and Society
 - Human Health
- **Assessment of Future Impacts and Adaptation: Regions**
 - Africa
 - Asia
 - Australia and New Zealand
 - Europe
 - Latin America
 - North America
 - Polar Regions
 - Small Islands
- **Assessment of Responses to Impacts**
 - Assessment of Adaptation Practices, Options, Constraints, and Capacity
 - Inter-relationships between Adaptation and Mitigation
 - Assessing Key Vulnerabilities and the Risk from Climate Change
 - Perspectives on Climate Change and Sustainability

WGII: Key Findings on Climate Change Impacts, Adaptation and Vulnerability

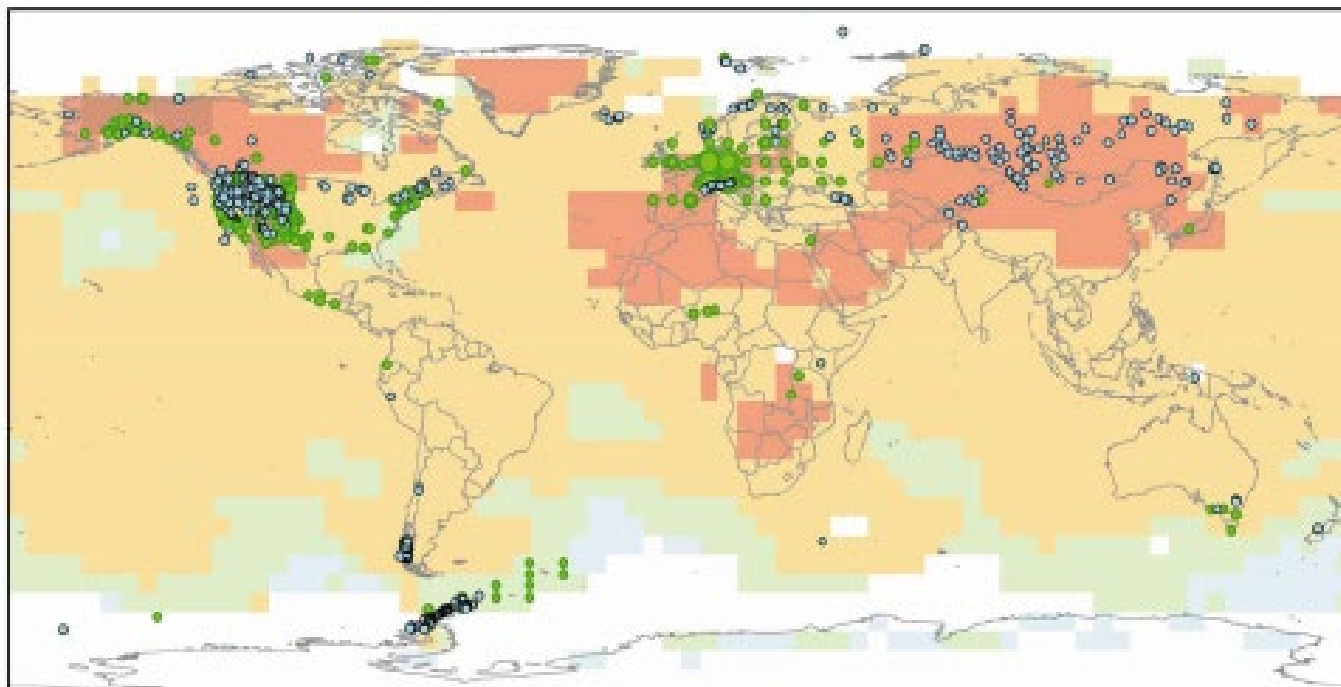


- More confident assessment of the relationship between observed warming and observed changes in physical and biological systems
- Greater confidence in ability to systematically estimate magnitude of impacts at different ranges of increases in global average temperature.
- *“Impacts due to altered frequencies and intensities of extreme weather, climate, and sea levels are very likely to change.”*
- *“Adaptation will be necessary to address impacts resulting from the warming which is already unavoidable due to past emissions.”*
- *“Future vulnerability depends not only on climate change but also on development pathway.”*
- *“Impacts of climate change will vary regionally but, aggregated and discounted to the present, they are very likely to impose net annual costs which will increase over time.”*

“...likely that anthropogenic warming has had a discernible influence on many physical and biological systems.”



Changes in physical and biological systems and surface temperature 1970-2004



Temperature change °C
1970-2004



Physical

Biological

significant
observed
changes

significant
observed
changes

% of significant
changes
consistent
with warming

% of significant
changes
consistent
with warming

NAM

355	455
94%	92%

LA

53	5
98%	100%

EUR

119	28,113
94%	95%

AFR

5	2
100%	100%

AS

106	8
98%	100%

ANZ

6	0
100%	-

PR*

120	24
91%	100%

TER

764	28,586
94%	90%

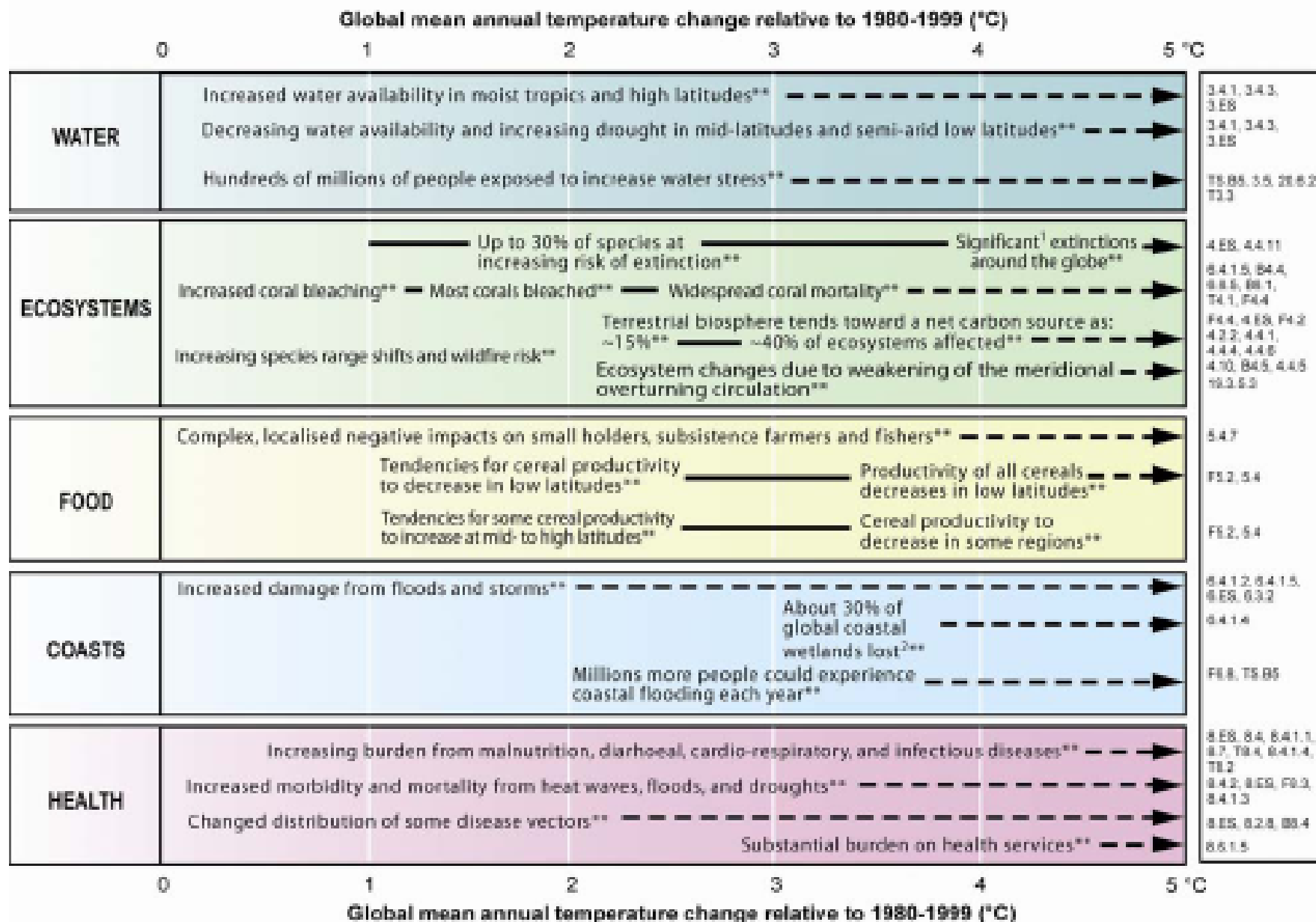
MFW**

1	85
100%	99%

GLO

765	28,671
94%	90%

Key Impacts as a Function of Increasing Global Average Temperature Change (Impacts will vary by extent of adaptation, rate of temperature change, and socio-economic pathway)



¹ Significant is defined here as more than 40%.

² Based on average rate of sea level rise of 4.2 mm/year from 2000 to 2080.

WGII: North American Chapter

Direct statements from Executive Summary



- *The vulnerability of North America depends on the effectiveness and timing of adaptation and the distribution of coping capacity, which vary spatially and among sectors.*
- *Coastal communities and habitats will be increasingly stressed by climate change impacts interacting with development and pollution.*
- *Climate change will constrain North America's already heavily utilized water resources, increasing competition among agricultural, municipal, industrial, and ecological uses.*
- *Climate change impacts on infrastructure and human health and safety in urban centers will be compounded by aging infrastructure, maladapted urban form and building stock, urban heat islands, air pollution, population growth, and an aging population.*
- *Without increased investments in countermeasures, hot temperatures and extreme weather are likely to cause increased adverse health impacts from heat-related mortality, pollution, storm-related fatalities and injuries, and infectious diseases.*
- *Disturbances like wildfire and insect outbreaks are increasing and are likely to intensify in a warmer future with drier soils and longer growing seasons.*

WGII: North American Chapter

Examples of Transportation impacts



- For North America's transportation system, the most serious issue is likely to be coastal flooding, especially along the Gulf and Atlantic coasts, because of sea-level rise and storm surges (Burkett, 2002)
- The long-term viability of some inland navigation routes is in question because of projections of lower water levels, due mainly to increased evaporation.
- Increased winter temperatures in the north, as already evidenced, would reduce the reliability of transport. Permafrost degradation reduces surface bearing capacity and potentially triggers landslides (Smith and Levasseur, 2002).
- An increase in the frequency, intensity and duration of heat spells is expected, and this raises concerns over pavement integrity because of the potential for softening and traffic-related rutting as well as the migration of liquid asphalt (flushing and bleeding) to pavement surfaces (Zimmerman, 2002). High temperatures are also of concern for rail operations, as track may buckle or kink (Rosetti, 2002). However, there are potential offsetting effects. At present, extreme cold is more problematic than heat for transport systems throughout Canada and northern parts of the U.S. (Warren *et al.*, 2004).